COLONIZATION PATTERN OF THE INFRALITTORAL HARD SUBSTRATE COMMUNITY IN THE NORTH AEGEAN SEA (CHALKIDIKI, GREECE). PRELIMINARY RESULTS

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Abstract

The present study aims to examine the colonization of hard substrata. Blocks from two different materials, cement and ceramic, are fixed on vertical rocky substrate, at a depth of 25 m and sampled every 3 months for a period of two years. The data analysis indicates that no significant differences exist between the two different materials, while there is a quite clear change in community structure during time. This change was more severe during the first stages of succession and became smoother after the first year.

Keywords: infralittoral, Aegean Sea, colonization, hard substrate

During the last years much effort has been devoted to the study of succession in marine communities (1,2,3,4,5), which is related to the protection and recovery of natural assemblages as well as to the development of artificial reefs (6,7,8). Cement and ceramic blocks have been immerged in northern Aegean Sea and fixed on natural rocky substrates. The main purpose was to examine the succession stages with time and material used. In this report we present the preliminary results of a 2-year survey.

Materials and methods

Twenty-four cement and twenty-four ceramic blocks (30x30 cm^2) were set by scuba divers on vertical natural rocky substrate, at a depth of 25m, in spring 1998, in a small natural port, Porto, Koufo, located in Sithonia at Chalkidiki peninsula. Every three months 3 blocks from each material were collected by divers and transferred to the laboratory, where the surface of each block was scrapped and all organisms were preserved in 10% formalin. Overall samples are available for 3, 6, 9, 12, 15, 18, 21, 24 months. All organisms were counted and identified at species level. The numerical abundance of the main taxa (polychaetes, mollusks, branchiopods, amphipods and tanaidaceas) per sampling month were analyzed using cluster and multidimensional scaling techniques, based on the Bray-Curtis similarity and 4-transformed numerical abundances, using PRIMER (9,10). The significance of the multivariate results was assessed using ANOSIM test (10).

Results and discussion

Overall 5.486 individuals were counted belonging to 105 species. 980 polychaetes were classified to 27 species, 3724 mollusks to 60 species, 34 branchiopods to 2 species and 511amphipods 15 species. The results of cluster and MDS analysis are shown at figure 1. The stress value for the 2 dimensional MDS plot was 0.12, indicating good group separation. Nevertheless because this value is >0.1, any conclusions must be crosschecked by the superimposition of cluster groups (10). The results of ANOSIM (R= 0.804, significance level is 0,4%) indicate discrimination between the groups of samples and therefore the cluster is confirmed. From these figures we observe two main groups: 3 and 3c and all the remaining months combined. The latter group was composed of months 6 to 12 for both material and another one from 15 to 24. A clear separation of the samples from the first 3 months of immersion (3 and 3c) at a 35% similarity level is obvious. We can also select 6 main groups determined at 55% similarity level. From the above it is evident in terms of species composition that no significant differences exist among the cement and the ceramic blocks. Some differences that were observed during the pioneer stages of the recruitment started to disappear after the first 9 months. A gradual change towards increasingly higher similarities during time is detectable. All samples derived from 18 to 24 months were classified together whereas the earlier samples were more dissimilar among each other and formed 5 different groups. In other words, the relatively high dissimilarity that occurred during the first months of the colonization process decreased gradually with time. Especially after the first year, as the assemblage attained a more complex synthesis in terms of diversity (Table 1.), all samples became more similar, something that is expected to continue until it reaches the final climax stage (5,6,7,8).

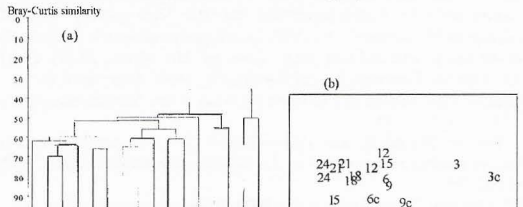

Figure I. Results of (a) cluster analysis and (b) multidimensional scaling, based on Bray-Curtis similarity index, of cement and ceramic(c.) blocks immerged in spring of 1998 and sampled every 3 months during 2 years of survey. The numbers correspond to the months that the blocks were immerged.

Table 1. Groups of samples occurred from the multidimensional scaling, where the species richness and the Shannon-Weaver index of diversity are calculated per group.

Group	Samples	Shannon intlex	Specles richness
1	3, 3c	1,947	21
2	6c, 9c	1,282	24
3	6, 9, 12, 12c, 15, 15c	1,004	42
4	18, 18c, 21, 21c, 24, 24c	1,078	58

Table 2. Species found from a 2-year survey, where the symbol * indicates the material (c: cement and cer: ceramic) from which each species has been collected.

Taxa (species	c	ce	Bittium latreillei (Payraudeau, 1826) *	*	
Laetmonice hystrix (Savigny, 1820)		*	Alvania cimex (Linnaeus, 1758)	*	*
Harmothoe areolata (Grube, 1860)	*	*	Alvania discors (Allan, 1818)	*	
Chrysopetalum debile (Grube, 1855)	*	*	Alvaniapaupercula (Jeffreys, 1867)	*	*
Phyllodoce madeirensis (Langerhans, 1880)	*	*	Manzonia crassa (Kanmacher, 1798)	*	*
Kefersteinia cirrata (Keferstein, 1862)	*	*	Pusillina radiata (Philippi, 1836)	*	*
Grubeosylbs limbata (Claparede, 1868)		*	Setia turriculata Monterosato, 1884	*	*
Sphaerosyllispirifera Claparede, 1868	*	*	Rissoina hruguieri (Payraudeau. 1826)	*	*
Syllis hyalina Grube, 1863	*	*	Caecum trachea (Montagu, 1803)	*	*
Syllisprolifera Krohn, 1852	*	*	Vermetus triquetrus Bivona Ant, 1832	*	*
Nereis zonata Malmgren, 1867	*	*	Payraudeauha intricata (Donovan, 1804)		*
Platynereis dumerilli (Audouin & MilneEdwars, 1833)		*	Monophorusperversus (Linnaeus, 1758)	*	
Glycera tesselata Grube, 1863	*	*	Metaxia metaxae (Delle Chiaje, 1828)	*	
Dorvillea rubrovittata (Grube, 1855)	*		Cerithiopsis tuberculans (Montagu, 1803)	*	*
Eunice vittata (delle Chiaje, 1929)	*	*	Epitonium commune (Lamarck, 1822)	*	
Lysidice ninetta Audoum & Milne Edwars, 1833	*	*	Melanella polita (Linaeus, 1758)	*	*
Nematonereis unicornis (Grube, 1840)	*	*	Muricopsis cristata (Brocchi, 1814)	*	*
Scoletomupunchalensis (Kinberg, 1865)	*	*	Pollia dorbignyi (Payraudeau, 1826)	*	*
Polyophthalmuspictus (Dujardin, 1839)	*	*	Nassarius incrassatus (S`troern, 1768)	*	*
Terebella lapidaria Linnaeus, 1767		*	Vexillum tricolor (Gmelin, 1791)	*	*
Amphiglena mediterranea (Leyding, 1851)	*	*	Bela nebula (Montagu, 1803)	*	
Hydroides norvegica Gunnerus, 1768	*	*	Mangelia attenuata (Montagu, 1803)	*	
Placostegus crystalinus sensu Zibrowius, 1968		*	Mangelia vauquelini (Payraudeau, 1826)	*	
Pomatoceros triqueter (l.innaeus, 1865)	*	*	Haedropleura septangulans (Montagu, 1803)	*	
Serpula concharum Langerhans, 1880	*	*	Mitrolumna olivoidea (Carnraine, 1835)	*	*
Spirobranchuspolytrema (Philippi, 1844)	*	*	Raphitoma echinata (Brocchi, 1814)	*	*
Vermilliopsis tnfundibulum (Gmelin, 1788)	*	*	Raphitoma leuiroyi (Michaud, 1828)	*	*
Spirorbis sp	*	*	Omalogyru atomus (Philippi, 1841)	*	*
Acanthochitonafasciculans Risso, 1826		*	Folinella excavata (Philippi, 1836)		*
Chiton (Rhyssoplax) olivaceus Spengler, 1797		*	Cylichnina umbilicata (Montagu, 1803)	*	*
Arca tetragona Poli, 1795	*	*	Haminoca navicula (Da Costa, 1778)	*	*
Musculus (Modiolaria) costulatus (Risso, 1826)	*	*	Philine aperta (Linnaeus, 1767)	*	*
Modiolus barbatus (Linnaeus, 1758)	*	*	Umbraculum wnbraculum (Roeding, 1798)		*
Modiolus adriaticus (Lamarok, 1819)	*	*	Discodoris atromaculata Bergh, 1880	*	
Lissopecten hyalinus (Poli, 1795)	*		Gwynia capsula (Jeffreys,)	*	*
Chlamys vana (Linnaeus, 1758)	*	*	Megathiris detruncata (Gmelin)	*	*
Lima (Mantellum) inflata (Link, 1807)	*	*	Microdeutopus anomalus (Rathke, 1843)	*	*
Spondylus gaccleropus Linnaeus, 1758	*	*	Dexamine spiniventris (NCosta, 1853)	*	*
Anomia ephippium Linnaeus, 1758	*	*	Dexamine spinosa (Montagu, 1813)	*	*
Myrtea spinifera (Montagu, 1803)	*	*	Lysianassa caesarea Ruffo, 1987	*	*
Acanthocardia aculeata (Linnaeus, 1758)	*	*	Lysianassa costoe Milne Edwards, 1830	*	*
Dosiniai (Pectunculus) exoleta (Linnaeus, 1758)	*	*	Penoculodes l.longimanus (Bate & Westwood, 1868)	*	*
Irus irus (Linnaeus, 1758)	*	*	Synchelidium longidigitatum Ruffo, 1947	*	*
Lenhdium mediterraneum (Costa, 1839)	*	*	Metaphoxus gruineri Karaman, 1986	*	*
Hiatella archca (Linnaeus, 1767)	*	*	Metaphoxus simplex (Bate, 1857)	*	*
Acmaea virginea (Mueller, 1776)	*	*	Stenothoe ca~fimana Chevreux, 1908	*	*
Emarginula octaviana Coen, 1939	*		Stenothoe monoculoides (Montagu, 1815)	*	*
Anatoma crispata Fleming, 1828	*	*	Caprella acanthifera Leach, 1814	*	*
Haliotis lamellosa Lamarck, 1822		*	Caprella rapax Mayer, 1890	*	*
Clanculus corallinus (Gmelin, 1791)	*	*	Phtisica marina Slabber, 1769	*	*
Gibbula magus (Linnaeus, 1758)	*	*	Unidentified sp. I	*	*
Jujubinus exasperatus (Pennant, 1777)	*	*	Leptochelia savignyi (Kroyer, 1842)	*	*
Homalopoma sanguineum (Linnaeus, 1758)	*	*	Cerithium vulgatum (Bruguiere, 1792)	*	*

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