L-VI8

AREAL DISTRIBUTION OF HEAVY METALS IN SEDIMENTS AND BENTHIC FAUNA FOR A SAMPLING STATION AND THE INTRODUCTION OF A "FIELD ERROR"

Boris S. KRUMGALZ and Moshe SAHLER

Israel Oceanographic Institute, Tel-Shikmona,
P.O.B. 8030, Haifa (Israel)

Numerous investigations have been conducted to study the hazardous effects of heavy metal input into the marine environment, including biota and sediments. Studies of seasonal and areal changes in heavy metal contents in these ecosystems raise a question about errors related to sampling procedures. It is obvious that it is impossible to carry out subsequent samplings at the exact same point. A repeated sampling procedure at the same stations during the same day was carried out in a relatively polluted area. Samples of sediments and benthic fauna were collected and analyzed for some heavy metal content. The scatter in the obtained results was very high. Therefore, the problem is how the errors related to the commonly accepted sampling procedure can reflect in the results concerning seasonal and areal changes in heavy metal contents in sediments and benthic fauna. We suggest calling the errors related to sampling procedures "field errors".

Experiments were conducted to find the "field error" and to assess the areal distribution of some heavy metals in sediments for two polluted stations. Three circular loci of points at radii of 10, 20 and 50 m from the central point were selected, and at each radius sediments were sampled at 4 points in the directions of east, west, north and south. The appropriate statistical test was selected to answer the question: whether or not there was a statistically significant difference between the mean values of heavy metal contents of these four groups of sampling. The statistical analysis demonstrated that most of the points under study were statistically similar. The inherent errors arising from sample collection procedure and mean "field error" values for lead, zinc and copper have been estimated and are presented in the table.

Mean "field errors" (%) for some heavy metals sampled in the vicinity of two stations

Station number	Pb	Zn	Cu
8	18.1	21.0	12.9
27	20.9	34.2	28.7

It can be concluded that even before samples are handled in the laboratory, there is already a considerable inherent error associated with the field work performed in obtaining sediment samples, and our "field error" offers a rough estimate of this inherent error. The apparent randomness of trace metal distribution in sediments found in this study seems to indicate the highly dynamic nature of trace metal pollution in sediments, subject to varying mechanisms for pollution migration. Some natural phenomena such as bottom currents could be expected to scatter waste particles less dense than sand but storms could extensively redistribute dense waste particulate on the sea floor. Since the proposed mean "field error" reflects the conditions of sediment movement and mixing and also possible pollutant migration, it should be determined for every set of sampling. In the present study, we offer to devise a model for redefining a station sampled to study more adequately trace metal pollution in surface sediments. There actually is no real definition for such a station as we know it; a station is simply some point in a body of water with no clear boundaries. We propose to define a station boundary quantitatively by determining a "statistical limiting radius" r. This r would represent the radius at which the circle mapped out would consist of points in which trace metal concentrations in surface sediments are statistically different from those trace metal concentrations found in surface sediments inside the circle mapped out by r.

L-VI9

ASSESSMENT OF BENTHOS AFTER THE INTRODUCTION OF AN OIL SPILL IN A GREEK EMBAYMENT

Aristidis DIAPOULIS and Costas BOGDANOS

National Center for Marine Research, Hellinikon, Athens (Greece)

No benthos study has ever been made in the bay of Navarin on the southwestern coast of the mainland (Fig.1). At February 1980 a tanker got wrecked in the bay and there was an oil spill. The bay of Navarin is small covering an area of about 16Km^2, depths do not exceed 60m and it communicates with the Ionian sea by two channels, the south one which is the bigger (1270 meter wide and about 70m deep) and the north one (very shallow, about 1m and its widht does not exceed 100m).

In June and December 1983, macrozoobenthos samples were taken in the bay following a rather dense station grid (distances between stations 0.5 Km). During the same seasons samples of marine flora were also taken inside and outside the bay. The stations outside were, M soutwards and R northwards, the results of these samplings were compared with the results of the samplings in the bay.

The purpose of the above samplings was the assessment of the benthic communities situation three and a half years after the introduction of crude oil from the tanker's "Irenes Serenade" shipwreck in the bay. Unfortunately there is no data or studies on the pre-wreck sitution in the area for comparative results.

DISCUSSION

a. Zoobenthos. Analysing qualitatively the duplicate samples of the two samplings (total area almost 6m^2), 249 species were determined.The distribution of the main groups was as follows: 124 species(49.8%) of the total belong to Polychaeta, 45 species(18%) to Mollusca, 49 species(20%) to Crustacea, 8 species(3%) to Echinodermata and the rest 23 species or 9.2% to miscellaneous minor groups.

Comparing the above data with the mean percentages of the groups from other bays in Greek waters, grown on similar soft substrates which is: Polychaeta 51%, Mollusca 15%, Crustacea 20%, Echinodermata 6.5% and Miscellaneous 7.5% (Bogdanos 1979,1980, Bogdanos and Satsmatzis 1983, Diapoulis and Bogdanos 1983), was found Polychaeta to be in the same percentages, Mollusca being slightly decreased, Crustacea almost the same, Echinodermata slightly decreased and the Miscellaneous almost the same. The main importance in our study lies on the fact that the percentage of Crustacea is almost the same wth the mean of other similar unpolluted areas. According to international studies on oil pollution it has been defined that, Crustacea and especially Amphipoda are very sensitive in oil pollution and can be used as negative oil pollution indicators (Sanders et al 1980). In our study the contribution of amphipoda to the total Crustacea found in Navarin bay was very high i.e.47% or 23 species to a total of 49. Being cautious because we unfortunately dont know the composition and contribution of amphipoda and generally of the biocoenoses before the accident,we believe that the biocoenoses in the bay have already recover.

George (1970) has shown experimentally that the organic carbon content of the sediment has been abruptly increased just after an oil introduction to about four times the original value and after four mouths being returned to the original value again. It is possible this quick recover to be attributed in intense microbial activity on the sediment surface. The same author also proved experimentally that the lethal effect of oil on two polychaete species is of no importance (on the contrary with Crustacea and Echinodermata) but of big importance after the use of dispertants. The values of organic carbon content in Navarin bay were normal, ranging from 0.58% at station 20 outside the entrance of the bay to 1.67% at station 18, there is also a very low value 0.08% outside the bay to the shallow and sandy station 26 (Fig.1).

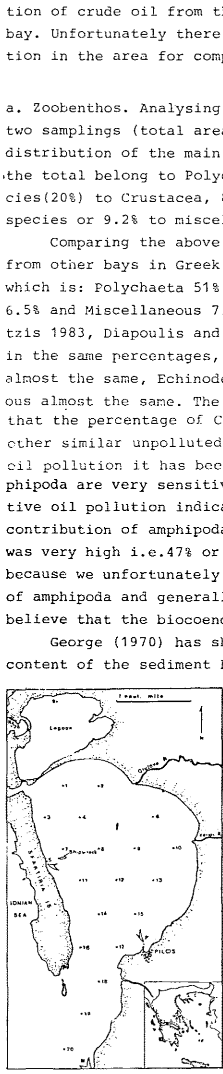

Fig.1

b. Phytobenthos. The totalspecies number determined inside and outside the bay was 124 and distributed as: 24 to Phaeophyceae, 2 to Chlorophyceae, 20 to Bryopsidophyceae and 78 to Rhodophyceae. Inside Navarin bay, during June 1983, were determined 81 species distributed as: 11 to Phaeophyceae, 2 to Chlorophyceae, 13 to Bryopsidophyceae and 55 to Rhodophyceae. During winter samplings at station P were determined 12 Phaeophyceae, 7 Bryopsidophyceae and 52 Rhodophyceae. From the stations studied, the two in the bay were the richest i.e. station P with 76 and S with 71 species. The same values are presented in the total covering of the species, the highest values of it being at the stations inside the bay.

REFERENCES

Bogdanos C.,1979.Biologia gallohellenica, (8),55-60.
Bogdanos C.,1980.Rapp.Comm.int.Mer Médit.,27,811-814.
Bogdanos C. and G.Satsmatzis,1983. Thalas.,(6):77-105
Diapoulis A. and C.Bogdanos,1983. Thalas.,(6):127-139.
George D.G.,1970. Br.Nat.Hist.Museum, 411-420.
SandersH.L. et al, 1980. Journ.of Mar.Research, 38:265-38[illegible]