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## IMPACT OF SLAG DEPOSITION ON DEMERSAL FISH ASSEMBLAGES IN THE N. EUVOIKOS GULF

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### 1. PROBLEM

The purpose of this contribution is to study the pollution effects of the discharge of the slag particles coming from the smalting of iron-nickel alloy in the N. Euvoikos Gulf. The nickel smelting factory utilises are containing 1 to 2 % nickel. Since 1969, it has been discharging slag holding 4% $Cr_2O_3$ and 35% Fe in the Gulf over an area of 67 Km and weighing so far a total of $25 \cdot 10^6$ tons (about $6.10^6$m). Investigation conducted by utilizing various indices of community structure.

### 2. MATERIAL AND METHODS.

To compare habitats, the sea area under study was divided into three ecological areas A, B abd C, according to the distance from the location where the slag is discharged. A (st. 1,3 and 4) is characterized by the presence of a layer of slag on the bottom, C (st.7 ,9 and 10 ) is far away from the first unpolluted, whilst B (st. 2, 5 and 6 ) lies between them. The samples were taken seasonally, from June 1983 to June 1984, using a 400 HP fishing trawler. The study is concerned with demersal fish fauna which is known to be strongly influenced from the sea bottom where the slag falls. Computations were made at each station as regards the number of fish species (S) and individuals (N), the Brillouin (H) and Shannon-Weaver (H') species diversity indices, the species richness (SR), the dominance and the index of overlap (Cl). Also the occurrence of slag in the stomach content was investigated in 143 hake and 175 red mullet.

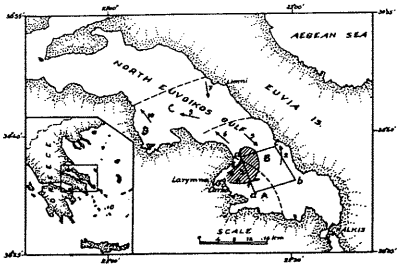


Fig.1. North Euvoikos Gulf and sampling stations.A, B and C areas affected by slag. a,b,c and d regions where the discharge of slag is allowed. ▨ presence of slag on the sea-bottom.

### 3. RESULTS.

The fish collected during this study total-27,713 individuals, representing 61 demersal species, weighing 891,3 Kg. A seasonal breakdown of the N and S data for all stations during the whole year of trawling shown that peak of S and N in the majority of the stations occurred during November September 1983 and June 1984, with seasonal changes in the number of individuals and species related to the fishing status of the Gulf,,trawl fishing is prohibited between the middle of November and the end of March. Comparing the catch per effort ( Kgr/h ) for each investigated station, it was concluded that the area B catches yielded generally higher catch than the other areas;no substancial differences in catch per effort were found between A and C. The dominance values do not completely reflect these results. Areas that were found to be under stress from slag had consistently lower dominance than the corresponding control areas.

The H and H' indices reflect the changes in relative abundance of species in each station. Peaks usually occurred in the stations of area A. Mean values reinforce the previous findings, but the statistical analysis does not confirm their significance. The mean value of the eveness factor presented a slight increase in areas affected by slag (area A). Peaks of SR usually occurred in most stations of the polluted area in September, November and March. The seasonal variation of SR was not found to differ significantly between areas A and B. From the study of Cl values those of areas A and B tend to present a greater similarity, supporting the hypothesis that there is a close relation in the fish assemblages belonging to the two slag affected areas. No sign of slag was found in the stomach content of hake because it feeds mainly on benthopelagic species. The good condition of the organisms which were found in the stomach of red mullet from areas A and B supports the view that the fish can be fed in these areas.

### 4. DISCUSSION

It is usually acknowledge that stressed conditions in benthic systems are related to low species diversity. Such areas are also characterized by a high level dominance and high productivity. This has been demonstrated with phytoplankton (PATTERN, 1962), zooplankton (ODUM et al., 1963),benthic macroinvertebrates ( BOESCH , 1972) and fishes ( ARMOSTRONG et al.,1971). In contrast with the above, TRAMER and ROGERS (1971) found that the gross pollution did not have a uniform effect on fish populations in the polluted areas. MARGALEF (1968) reported that the diversity of the demersal fish populations trawled along the Mediterranean Spanish coast ranged from 1.4 to 3.5 . He noted that all values of diversity fell in a rather narrow ranges, with an upper limit near of 4.5, representing an efficiency limit that aquatic communities may not be able to surpass. If the above figures are taken as guidelines then fish diversity indices can be used as a tool for stress analysis in the present study. The small and uncorrelated differences found in the fish diversity indices among the three areas A, B and C indicate that the whole study area is moderately stressed by pollution.

### REFERENCES

ARMOSTRONG,N.,P.N.STORS and E.A.PEARSON, 1971. Development of a gross toxicity criterion in San Francisco Bay. Int.Conf.Wat.Pollut.Res.,3 :1 -15.

BOESCH,D.F., 1972. Species diversity of marine macrobemthos in the Virginia area. Chesapeake Sci., 13 ;206 - 212.

MARGALEF, D.R., 1968. Information theory in ecology. Gen. Syst., 3:36 - 71.

ODUM,H.T., R.P.CUZON du REST, R.J.BEYERS and C.ALLBAUGH, 1963. Diurnal metabolism, total phosphorus, ohle anomaly and zooplankton diversity of abnormal marine ecosystems of Texas. Publs. Inst. Mar. Sci. Texas, 9 :404- 453.

PATTERN,B.C., 1962. Species diversity in net phytoplankton of Raritan Bay. J.Mar.Res., 20 :57-75.

TRAMER, E.J. and P.M.ROGERS, 1973. Diversity and longitudinal zonation in fish population of two streams entering a metropolitan area. Am. Midl. Nat., 90 366-374.

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## TRACE METALS IN THE COASTAL MARINE WATERS FROM THE SOUTHERN PART OF THE ROMANIAN BLACK SEA COAST

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RESUME.- Les valeurs moyennes annuelles des métaux trace, dans les eaux de surface de l'isobathe de 10 mètres, du sud du littoral roumain, durant la période allant de 1982 à 1985, ont varié entre 1,44 - 3,80 µg/l Cu; ND - 3,0 µg/l Pb; 7,95 - 22,48 µg/l Zn et ND -12,35 µg/l Fe. Ces données sont inférieures à celles rapportées par divers auteurs pour d'autres zones maritimes similaires considérées comme polluées.

The southern part of the romanian Black Sea coast is more developed from the social-economical point of vue than the northern one. Therefore, the complex studies of monitoring and maintaing the marine environment quality aimed especially this area.

### METHODOLOGY

Twice a year during 1982-1985 water samples were taken from 5 stations points of - 0.5 m depth along the 10 m contour line.

The concentration and metals extraction were performed by means of APDC and MIBK, accurate measures being taken in order to avoid contamination. An AAS-PYE UNICAM-$SP_{2900}$ was used.

### RESULTS AND DISCUSSION

The mean values and variation scales are presented in the Table 1. The Table 2 presents the data published by others authors concerning similar marine areas.

Table 1 - Variation scale and mean values (µg/l)

| Year | Cu | Pb | Zn | Cd | Fe |
|---|---|---|---|---|---|
| 1982 | 2.40-4.90 (3.80) | N.D. (-) | 7.10-10.10 (8.2) | 0.05-0.16 (0.08) | |
| 1983 | 0.60-4.06 (2.28) | N.D. (-) | 1.87-46.50 (20.36) | 0.17-1.60 (0.65) | 2.12-66.0 (12.86) |
| 1984 | 2.0 -6.25 (1.44) | N.D-1.87 (0.83) | 2.20-27.50 (7.95) | N.D. (-) | - - |
| 1985 | N.D.-7.0 (1.81) | N.D.-12.70 (3.0) | 1.40-91.10 (22.48) | N.D. (-) | N.D.-53.0 (12.35) |

The obtained results point out that during 1982-1985 the yearly mean values varied within the limits of: 1.44-3.80 µg/l for Cu; N.D.-3.0 µg/l for Pb; 7.95-22.48 µg/l for Zn; N.D.-0.65 µg/l for Cd and N.D.-12.35 µg/l for Fe.

An increase tendency of values from one year to another is noticed. In the most situations this increase is proper to the upper limit of the scale. The explanation consists in industrial used waters discharge in that area where the increasing of values was determined.

For the remaining part of the studied area the mean values are placed in the inferior part of the scale, which demonstrates a slight content of heavy metals.

Our data compared with those published by other authors (Table 2) showed that the coastal waters from the southern part of Black Sea Romanian shore are still not affected by the heavy metals pollution.

Table 2 - Trace metals in the marine water from some others oceanic areas(µg/l)

| Cu | Pb | Zn | Cd | Fe | |
|---|---|---|---|---|---|
| 12-31 40-90 | 1-5 | 37-76 60-2020 | | 100-760 | Gemlik, CURI E.Port Alexandria, EL-SAYED et al. |
| | 0.99-11.6 | 1.1-315 | | | N.Adriatic,BRANICA et al. |
| | 0.05-10 | | | | NW-Italy, MART et al. |
| | | | N.D.-3,5 | | Lagoon Brusc,CHABERT |

N.D. - not detected

### CONCLUSIONS

In the Southern part of the Romanian inshore waters (10 m contour line) heavy metals pollution was not erecorded.

### Reference

1. BERNHARD M., 1982 - Levels of trace metals in the Mediterranean. VI^es Journées Étud.Pollutions, Cannes, CIESM: 237-243.

2. CHABERT D., VICENTE N., 1980 - Pollution chimique par les métaux lourds et les composés organochlorés d'un milieu lagunaire (Lagune du Brusc, Méditerranée, France). V^es Journées Étud.Pollutions, Cagliari, CIESM: 323-335.

3. CURI M., 1978 - Pollution studies in the sea of Marmara and Black Sea. IV^es Journées Étud.Pollutions, Antalya, CIESM: 223-227.

4. SERBANESCU O., PECHEANU I, MIHNEA R., 1978 - Ions métalliques dans les eaux du Danube a l'embouchure et dans les eaux marines cotieres (littoral roumain de la mer Noire). IV^es Journées Étud.Pollutions, Antalya, CIESM: 219-223.

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