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THE POLYCHAETOUS ANNELID AND ENVIRONMENT IN THE INTERTIDAL FLAT, INCHON, KOREA

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ABSTRACT

This work concerns with the biotic study of the polychaeta population in the intertidal flat, Inchon, Korea. *Magelona japonica* was found to be the most abundant species, comprising 54% of total organisms examined. The presence of large numbers of *Magelona japonica* and *Sternaspis scutata*, high value of species diversity indices (H(s)), and the absence of the particular pollution indicator species, except a few *Prinospio pinnata*, suggest that the study area appears not to be polluted during the study period.

INTRODUCTION

As civilization progresses, it's by-product, that is, pollution affects the natural environment greatly. In some region, it is severe enough to destory the ecosystem.

Sanders (1960) studied the structure of the soft bottom community in Buzzards Bay. Sneli (1968) studied the density and zonation of intertidal polychaetes and molluscs on a muddy shore in Öydegard, Norway. Sanders (1968) compared the population density of benthic invertebrates in various intertidal and subtidal zones. Johnson (1970) found high relations between animals and sediments in Tomales Bay, California.

In Korea, the studies on the water pollution have beeen made by several researchers(Choe, 1968 and 1972; Won and Park, 1973; Lee et al, 1974; Kwak and Lee, 1975). However, the ecology of intertidal communities in connection with pollution has seldom been studied. Only, Yi (1975) surveyed the composition of benthic fauna, species diversity, faunal affinity, and distribution of the intertidal connnunities at Yong Ho Bay Busan. He reported that there was no relation between the faunal distribution and organic matter contents of the sediments.

The main prupose of this study is to survey the polychaeta population in the intertidal flat and to find out effects of possible environmental stresses.

MATERIALS AND METHODS

1. Description of study area

The study area is located in Inchon Bay and has approximately 2.5 Km^2 in area (Fig. 1). In the study area, the flood current begins 0.4 hours after low tide to the northern direction, and maximum velocity is known to be 3.0-3.5 Knots. The ebb current begins 0.7 hours after high tide with maximum velocity of 4.0-4.5 Knots (Yi, 1972). The average tidal range is known to be 8.6 m during the spring tide, and 6.1 m during the neap tide. The study area is composed of muddy bottom, and most area is exposed during the low tide except Line II which is a tidal channel.

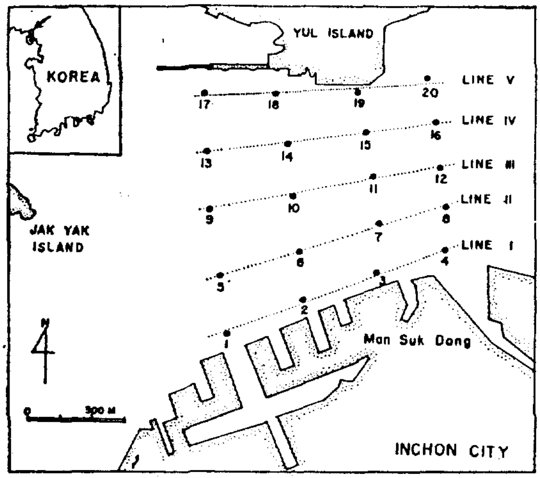

Fig. 1. Map showing the sampling stations

A total of 96 grab samples was taken systematically from 20 stations along 5 Lines during high tide from February 12 to March 16, 1976.

2. Methods of study

A Peterson grad sampler, covering appoximately 0.02 square meters in area was used to collect the benthos samples. The samples were passed through 0.5 mm sieve with running water, and the organisms left in the sieve were submerged in menthol solution for 30 minutes. The organisms thus collected were later preserved in 5% formalin solution, and identified under the binocular microscope.

Subsamples (about 200 g) were taken from each station prior to sieving. From the subsamples of each station, 10 grams were used to analyze COD of the bottom sediments.

20 cc of the squeezed water from the sediments were prepared by the centrifuger and *p*H were measured with a portable *p*H meter (Model 126A, Photovolt Cooperation).

Another 20 grams of the subsamples were combusted at 500-600°C in a furnace for two hours, and the loss of weight was used as an estimate of organic matter.

Species diversity was measured with the Shannon-Wiener Information Function (Shannon and Weaver, 1963). The equation is as follows:

$$H(s) = -\sum Pi \ Log_2 \ Pi \quad \text{where } P = ni/N:$$

N : Total number of individuals

ni : Total number of each species

Statistical test was applied by means of correlation coefficient to find out the relationship between COD of sediments and number of individuals, and COD and number of species.

RESULTS AND DISCUSSION

1. *p*H

The *p*H of all the study area was shown to be nearly neutral(Table 1). The mean value of *p*H was 7.44, with maximum value at St. 17 (7.90) and minimum value at St.2 (7.02). These values are considered as a normal *p*H for environmental standard.

Table 1. *p*H of sediments at each station

Station No.	*p*H	Station No.	*p*H
1.	7.20	11.	7.15
2.	7.02	12.	7.25
3.	7.40	13.	7.80
4.	7.28	14.	7.38
5.	7.58	15.	7.20
6.	7.78	16.	7.89
7.	7.30	17.	7.90
8.	7.11	18.	7.40
9.	7.53	19.	7.46
10.	7.40	20.	7.78

2. COD and Organic Matter

The COD of the sediments in the study area showed somewhat wide range. The COD of Line I was twice higher than that of the other Lines. The mean value of COD was 4.47mg/g., the highest one was 9.65mg/g. at St. 2, and the lowest one 2.27mg/g. at St.14(Fig. 2).

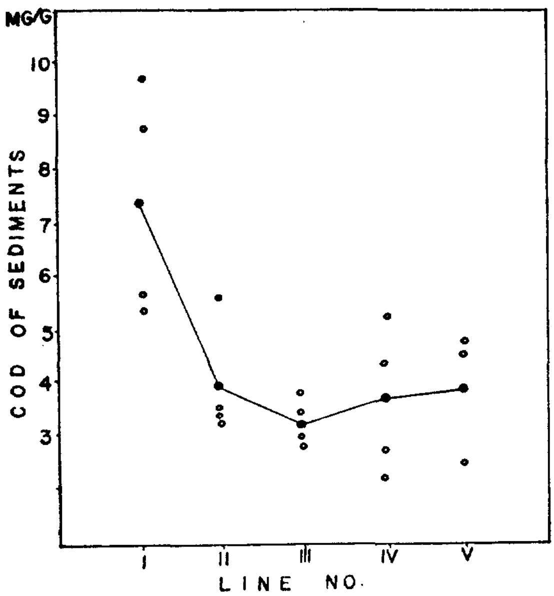

Fig. 2. Distribution of COD of sediments at each station (A line indicates the mean value)

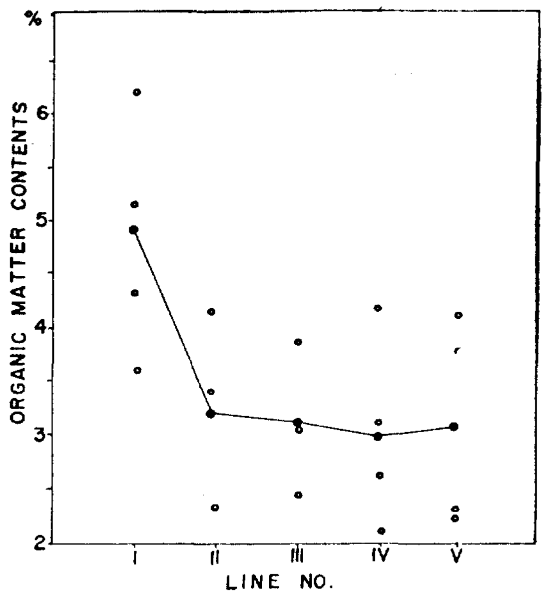

Fig. 3. Distribution of organic matter contents at esch station(A line indicates the mean value)

These values are much lower than the results of Miyake and Ukida (1967) who observed the COD value ranging from 10.0mg/g. to 29.9mg/g. in Mizushima Bay, Okayama prefacture in Japan.

The range of organic matter contents was shown to be 2.02—6.22% in weight (Mean: 3.47%) as shown in Fig. 3.

This value is somewhat lower than those of other three similar habitats: Sanders (1960) reported 6.0—7.4% of organic matter contents in Buzzards Bay, and Johnson and Matheson (1968) exceeded 15% in weight from the sediment of Hamilton Bay, and Yi (1975) found 4.7—12.2% at Yong-ho Bay, Busan.

3. Species Composition

From 96 grab samples a total of 27 species was observed (Table 2). Among these, the most abundant species was found to be the off-shore polychaetous species, *Magelona japonica*. *Magelona japonica* comprised 54% of total individuals examined. The St. 7 in Line II, St. 9 and 10 in Line III and St. 16 in Line IV had

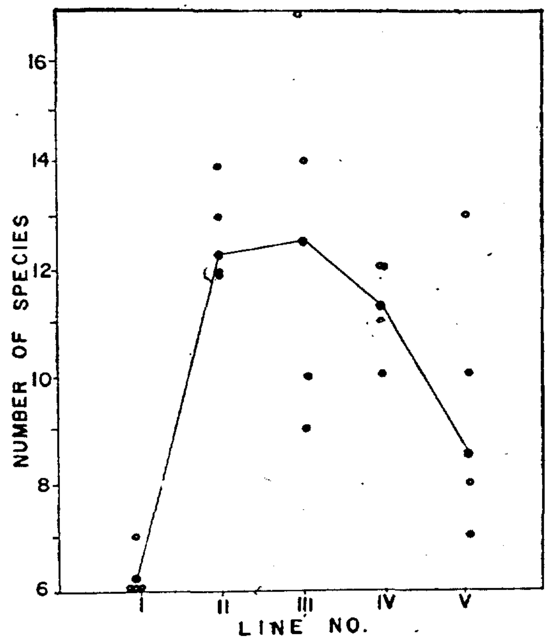

Fig. 4. Number of species per 0.1m² at each station (A line indicates the mean value)

145, 141 151 and 148 individuals of *Magelona japonica* per 0.1m² respectively. However in Line I and Line V, *Nephtys brachycephala* and *Magelona japonica* were found to be dominant. *Sternaspis scutata*, another off-shore water spe-

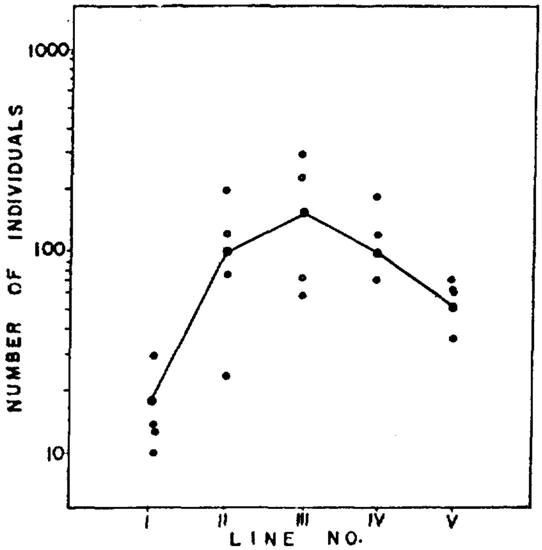

Fig. 5. Number of individuals per 0.1m² at each station (A line indicates the mean value)

Table 2. Number of Species, and Individuals of Polychaetes per 0.1m² at each station

Line No.	Station No.	No. of Species	No. of Individuals	Biotic Index (sps./ind.)
	1.	5	11	0.45
I	2.	4	31	0.12
	3.	7	18	0.39
	4.	5	19	0.26
	5.	9	25	0.36
II	6.	11	79	0.14
	7.	12	202	0.06
	8.	12	129	0.09
	9.	14	318	0.04
III	10.	9	238	0.04
	11.	8	59	0.14
	12.	8	76	0.11
	13.	9	124	0.07
IV	14.	8	113	0.07
	15.	9	76	0.12
	16.	8	194	0.04
	17.	7	36	0.19
V	18.	7	71	0.10
	19.	4	59	0.07
	20.	10	61	0.16
TOTAL VALUE		18	1,939	0.01

cies, were also observed. However there was not found any pollution indicator species except a few individuals of *Prinospio pinnata*.

Fig. 4 shows the mean values of species that observed at each station in each Line per 0.1m². The highest value was 17 at St. 9, lowest value was 6 at St. 1, 2 and 4.

The average density of benthic invertebrates per Line increased from 20 individuals per 0.1 m² in Line I to a maximum of 172 individuals in Line III. This then fell to 127 individuals in Line IV and 57 individuals in Line V (Fig. 5).

4. Species diversity

The mean value of species diversity indices per Line was almost same through the whole Lines. It was highest (H(s)=2.47) in Line II, and lowest (H(s)=2.04) in Line IV. However, there were high variations among the stations, 3.06 at St. 20 and 1.50 at St. 16 (Fig. 6).

The diversity indices except St. 7, 12, 13 and 16 were higher than the normal value, 1.68 observed in Lower Mystic River by Rowe et al (1972).

In Fig. 7 is shown the correlation between

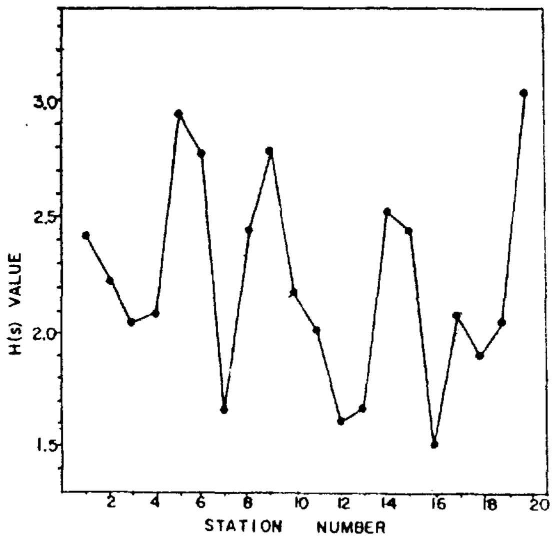

Fig. 6. H(s) at each station

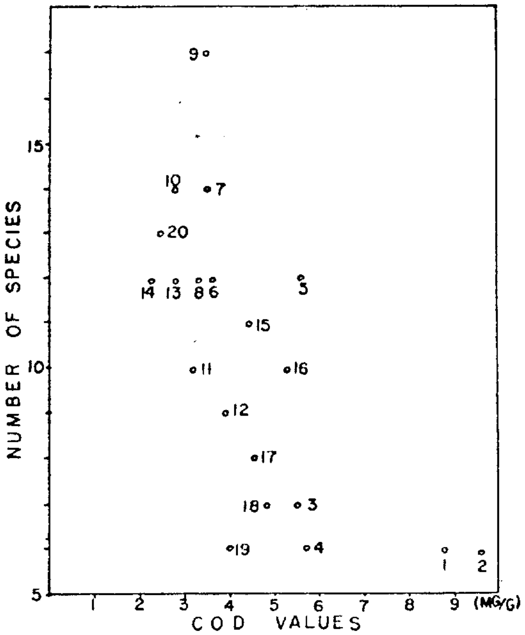

Fig. 7. Correlation between number of species and COD of sediments. (The digits show the station number)

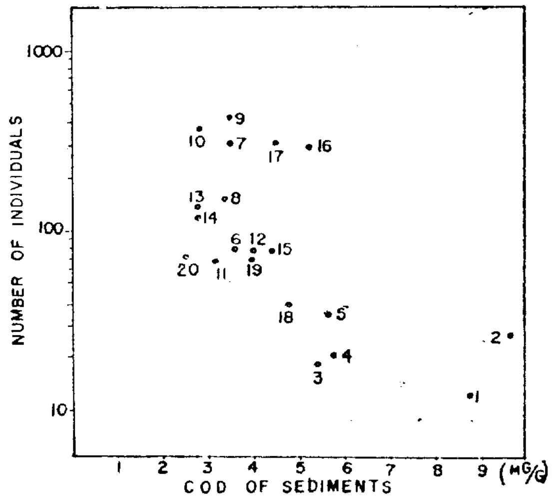

Fig. 8. Correlation between number of species and COD of sediments. (The digits show the station number)

number of species and COD of the sediments. The correlation coefficient was calculated to be -0.425 ($t=-2.20$). For d.f. 18, the value of significant level at 5% is 2.10 with "t" distribution. So, this correlation is shown to be significant at 5% level. In other word, it can be said that as the stress increases, the density of species decreases.

The relationship between total individuals per station and COD value of sediments shows same pattern as the relationship between number of species and COD value. Fig. 8 shows the correlation between total individuals at each station and COD of sediments. The correlation coefficient was calculated to be -0.305($t=-1.36$). At the 5% significance level, their relationship is considered not to be significant.

5. Discussion

In view of the foregoing results, it may be considered the study area appears not to be polluted during the study period. The fact that there was not found any pollution indicator species except a few *Prinospio pinnata*, suggests the above mentioned consideration. Moreover, the presence of *Magelona japonica* and *Sternaspis scutata* which are abundant in the area that is influenced by the off-shore water, also support the above consideration. There could have been a lot of pollutants due to municipal and coastal plant sewages, however it might have been diversed rapidly by the strong tidal current prevalent in the study area.

SUMMARY

A total of 96 grab samples was taken by a Peterson grab sampler at 20 stations during the period from February 12 to March 16, 1976 during high tide.

The results obtained are summerized as follows.

1. The most abundant species was found to be *Magelona japonica*, comprising 54% of total individuals examined.
2. The correlation between COD of sediments and number of species was found to be sig-

nificant ($r = -0.425$) at 5% significance level, hower the correlation between COD and number of individuals was not significant at the same level.

3. The abundance of *Magelona japonica* and *Sternaspis scutata*, suggests that the study area has strong tidal currents.
4. H(s) value of species diversity indices of the study area did not show any relationship with COD of sediments.
5. No significant pollution indicator species was found in the study area except a few *Prinospio pinnata*.

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